CO_2 electroreduction on Mo_2C films

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The material class of transition metal carbides (TMCs) has gained in importance among electrocatalysts for reduction processes such as the hydrogen evolution reaction (HER) and the CO_2 reduction reaction (CO_2RR). In the CO_2RR, theoretical calculations [1] predict that TMCs are promising alternatives to Cu catyalysts due to their ability of breaking the binding energy scaling relations for the corresponding reaction intermediates, which has been experimentally shown to result in less negative onset potentials for hydrocarbon formation on Mo_2C compared to Cu [2]. For a comprehensive understanding of the electrocatalytic properties of Mo_2C towards the CO_2RR, the present study aims at merging materials science and interface analytics with electrochemistry. We report on the synthesis of Mo_2C films using physical vapor deposition by magnetron sputtering, as well as by direct carburization of polycrystalline Mo substrates through carbothermal conversion. Cyclic voltammetry was used to investigate the electrocatalytic activity of the Mo_2C films towards the CO_2RR in acidic media, while changes of the chemical composition at the surface were analyzed with *ex situ* emersion X-ray photoelectron spectroscopy (XPS) experiments. Subtractively normalized interfacial Fourier transform infrared spectroscopy (SNIFTIRS) enabled the *in situ* determination of adsorbed reaction intermediates at the solid/liquid interface.

[1] Michalsky, R.; Zhang, Y. J.; Medford, A. J.; Peterson, A. A., *J. Phys. Chem. C* **2014**, *118* (24), 13026–13034.

[2] Kim, S. K.; Zhang, Y. J.; Bergstrom, H.; Michalsky, R.; Peterson, A., *ACS Catal.* **2016**, *6* (3), 2003–2013.